

Claims

1. Method of assembling a cap (20) of a closure device (9) with an open end (6, 7) of a housing container (5) to form a container system (1) for body fluids, tissue parts or tissue cultures, whereby a relative rotating or pivoting movement is effected about a common longitudinal axis (14) between the cap (20) and the housing container (5), characterised in that an axially directed pressing force(F) is applied to at least one of the components (5, 20) to be assembled more or less in the direction of the longitudinal axis (14) in order to generate the relative movement.
2. Method as claimed in claim 1, characterised in that the pressing force (F) is applied to the cap (20) of the closure device (9).
3. Method as claimed in claim 1 or 2, characterised in that, when the pressing force (F) is being applied, the cap (20) is held stationary relative to the housing container (5) and the housing container (5) is displaced in the relative rotating or pivoting movement.
4. Method as claimed in claim 1 or 2, characterised in that the housing container (5) is held stationary relative to the cap (20) when the pressing force (F) is being applied.
5. Method as claimed in one of the preceding claims, characterised in that the relative rotating or pivoting movement is caused by the pressing force (F) with an intensity of between 10N and 50N.
6. Method as claimed in one of the preceding claims, characterised in that, before screwing on the cap (20), a sealing device (21) is inserted in it.
7. Method as claimed in one of the preceding claims, characterised in that the relative rotating or pivoting movement about the common longitudinal axis (14) is caused by at least certain regions of threads (42, 43) of a thread arrangement (40) co-operating with one another.
8. Method as claimed in one of the preceding claims, characterised in that, before applying the pressing force (F), one of the components (5, 20) to be assembled is pre-positioned

relative to the other one of the components (20, 5) to be assembled by a free rotation about the common longitudinal axis (14).

9. Method as claimed in one of the preceding claims, characterised in that, during the relative rotating or pivoting movement about the common longitudinal axis (14), the threads (42, 43) of the thread arrangement (40) engage with one another across the entire length of the screwing-in path until the fully screwed-in position is reached.

10. Method as claimed in one of the preceding claims, characterised in that , before the assembly process on at least one component (9, 5) forming the container system (1), a coating is applied.

11. Method as claimed in claim 10, characterised in that the coating is applied to at least certain areas in the region of a coupling mechanism (37) between the cap (20) and the housing container (5).

12. Method as claimed in claim 10 or 11, characterised in that the coating is applied to the part of the thread arrangement (40) disposed on the housing container (5).

13. Method as claimed in one of claims 10 to 12, characterised in that the coating is applied to the part of the thread arrangement (40) disposed on the cap (20).

14. Method as claimed in one of claims 10 to 13, characterised in that the coating is applied to a sealing surface (33) of a stopper (48) of the sealing device (21) directed towards the housing container (5).

15. Method as claimed in one of claims 10 to 14, characterised in that the coating is applied to an internal surface (18) of the housing container (5) facing the sealing surface (33) of the stopper (48) of the sealing device (21).

16. Method as claimed in one of claims 10 to 15, characterised in that the coating is applied to the respective coating region continuously or all over.

17. Method as claimed in one of claims 10 to 16, characterised in that the coating reduces friction between the components to be assembled in readiness for the joining operation.

18. Method as claimed in one of the preceding claims, characterised in that several caps (20) of the closure device (9) are assembled with the housing containers (5) simultaneously to form the container system (1) in a common assembly unit.

19. Cap (20) for forming a closure device (9) for a housing container (5) of a container system (1) for body fluids, tissue parts or tissue cultures, which cap (20) comprises a cap casing (23), two end regions (38, 39) spaced apart from one another in the direction of a longitudinal axis (14) and at least a first part of a thread arrangement (40) extending on an internal surface (41) of the cap casing (23), characterised in that a pitch angle (50) of at least one thread (43) of the thread arrangement (40) is selected from a range with a lower limit of 2° and an upper limit of 30° by reference to a plane (49) oriented perpendicular to the longitudinal axis (14).

20. Cap (20) as claimed in claim 19, characterised in that the pitch angle (50) is selected from a range with a lower limit of 3° , in particular 5° , preferably of 8° , 10° , 13° , 15° and an upper limit of 25° , in particular 20° , preferably of 16° , 13° , 12° .

21. Cap (20) as claimed in claim 19 or 20, characterised in that the pitch angle (50) is 9° or 10° or 11° or 12° .

22. Cap (20) as claimed in one of claims 19 to 21, characterised in that the at least one thread (43) is formed by several first thread segments (99) in its longitudinal extension disposed one after the other and spaced at a distance apart as viewed in the circumferential direction.

23. Cap (20) as claimed in one of claims 19 to 22, characterised in that the thread arrangement (40) is made up of several threads.

24. Cap (20) as claimed in claim 23, characterised in that the thread arrangement (40) comprises three threads (43) distributed around the internal surface (41).

25. Cap (20) as claimed in claim 23 or 24, characterised in that thread beginnings (51 to 53) of the individual threads (43) are offset from one another in the circumferential direction by approximately 120°.

26. Cap (20) as claimed in one of claims 19 to 25, characterised in that a respective thread length of the individual threads (43) making up the thread arrangement (40) are the same as or smaller in the plane (49) oriented perpendicular to the longitudinal axis (14) as viewed around the circumference than an internal circumference of the cap casing (23) in the region of the thread arrangement (40).

27. Cap (20) as claimed in one of claims 19 to 26, characterised in that a thread (43) extends more or less across half the internal circumference of the cap casing (23).

28. Cap (20) as claimed in one of claims 19 to 27, characterised in that the at least one thread (43) projects out from the internal surface (41) of the cap casing (23) in the direction towards the longitudinal axis (14).

29. Cap (20) as claimed in one of claims 19 to 28, characterised in that the internal surface (41) of the cap casing (23) is provided with a coating at least in the region of the thread (43).

30. Cap (20) as claimed in one of claims 19 to 29, characterised in that at least certain regions of the thread arrangement (40), in particular the thread or threads (43), are provided with the coating.

31. Cap (20) as claimed in claim 29 or 30, characterised in that the coating is formulated with a view to reducing friction and contains at least one lubricant or a lubricant additive.

32. Cap (20) as claimed in one of claims 29 to 31, characterised in that the coating and/or a lubricant is supplied from at least one recess (101) in the region of the thread (43).

33. Cap (20) as claimed in one of claims 19 to 32, characterised in that the lubricant or lubricant additive is already added to or incorporated in the material used to make it.

34. Cap (20) as claimed in one of claims 19 to 33, characterised in that the at least one thread (43) has a surface roughness of between $0.0125\ \mu\text{m}$ and $0.05\ \mu\text{m}$ on at least one portion co-operating with the thread (42) of the housing container (5).

35. Cap (20) as claimed in one of claims 19 to 34, characterised in that a sealing device (21) can be retained in it by means of a coupling mechanism (28).

36. Cap (20) as claimed in claim 35, characterised in that the coupling mechanism (28) is provided in the form of projections (29, 30) spaced at a distance apart from one another in the direction of the longitudinal axis (14) and disposed on at least certain regions around the internal circumference, projecting out from the cap casing (23) in the direction towards the longitudinal axis (14), which form a groove-shaped accommodating region on the internal face of the cap casing (23).

37. Cap (20) as claimed in claim 35 or 36, characterised in that at least one passage (102) is disposed in the portion of the groove-shaped accommodating region in the cap casing (23), in at least certain regions of which the insertable sealing device (21), in particular its shoulder (32), engages.

38. Cap (20) as claimed in claim 37, characterised in that several passages (102) are distributed around the circumference.

39. Cap (20) as claimed in one of claims 19 to 38, characterised in that an internal clearance width (118) of the projection (30) which can be placed facing an open end (6) of a housing container (5) approximately corresponds to an external dimension (119) of the housing container (5) in the region of its open end (6).

40. Housing container (5) for forming a container system (1) for body fluids, tissue parts or tissue cultures which can be closed off by means of a closure device (9), which housing container (5) has two ends (6, 7) spaced apart from one another in the direction of a longitudinal axis (14) and bounding an interior (10), and at least one of the two ends (6, 7) has an open end face (19) which can be closed by the closure device (9) which can be opened again, and at least a second part of a thread arrangement (40) is provided on an external surface (18) of

the housing container (5), characterised in that a pitch angle (60) of at least one thread (42) of the thread arrangement (40) is selected from a range with a lower limit of 2° and an upper limit of 30° by reference to a plane (49) oriented perpendicular to the longitudinal axis (14).

41. Housing container (5) as claimed in claim 40, characterised in that the pitch angle (60) is selected from a range with a lower limit of 3° , in particular 5° , preferably of 8° , 10° , 13° , 15° , and an upper limit of 25° , in particular 20° , preferably of 16° , 13° , 12° .

42. Housing container (5) as claimed in claim 40 or 41, characterised in that the pitch angle (60) is 9° or 10° or 11° or 12° .

43. Housing container (5) as claimed in one of claims 40 to 42, characterised in that the at least one thread (42) is made up of several other thread segments (100) disposed one after the other and spaced at a distance apart from one another along its longitudinal extension as viewed in the circumferential direction.

44. Housing container (5) as claimed in one of claims 40 to 43, characterised in that the thread arrangement (40) is made up of several threads.

45. Housing container (5) as claimed in claim 44, characterised in that the thread arrangement (40) comprises three threads (42) distributed around the external surface (18).

46. Housing container (5) as claimed in claim 44 or 45, characterised in that thread beginnings (54 to 56) of the individual threads (42) are offset from one another in the circumferential direction by approximately 120° .

47. Housing container (5) as claimed in one of claims 40 to 46, characterised in that the sum of the thread lengths of the threads (42) making up the thread arrangement (40) in the plane (49) oriented perpendicular to the longitudinal axis (14) as viewed around the circumference is the same as or smaller than an external circumference of the housing container (5) in the region of the thread arrangement (40).

48. Housing container (5) as claimed in one of claims 40 to 47, characterised in that the

thread (42) extends with its full thread height (62) between its thread beginning (54 to 56) and its thread end (57 to 59) across an angle (61) of between 50° and 80° as viewed around the circumference.

49. Housing container (5) as claimed in claim 48, characterised in that the angle (61) is approximately 65°.

50. Housing container (5) as claimed in one of claims 40 to 49, characterised in that the thread (42) has a thread outlet (63) in the portion of its thread beginning (54 to 56), starting from its full thread height (62), which constantly decreases in height towards the external surface (18).

51. Housing container (5) as claimed in one of claims 40 to 50, characterised in that the thread (42) has another thread outlet (64) in the portion of its thread end (57 to 59), starting from its full thread height (62), which constantly decreases in height towards the external surface (18).

52. Housing container (5) as claimed in claim 50 or 51, characterised in that the thread outlet (63, 64) is formed by a transition radius (65).

53. Housing container (5) as claimed in one of claims 40 to 52, characterised in that the respective threads (42) directly adjacent to one another in the circumferential direction are spaced at a distance apart from one another.

54. Housing container (5) as claimed in one of claims 40 to 53, characterised in that a thread cross-section of the thread (42) is non-symmetrical in a plane oriented parallel with and extending through the longitudinal axis (14).

55. Housing container (5) as claimed in one of claims 40 to 54, characterised in that the thread cross-section has an apex surface (72) in the portion of the full thread height (62) of the thread (42) oriented parallel with the longitudinal axis (14).

56. Housing container (5) as claimed in one of claims 53 to 55, characterised in that the

thread cross-section on the side directed towards the open end face (19) of the housing container (5) is bounded by a first radius (67) starting from the apex surface (72) towards the external surface (18).

57. Housing container (5) as claimed in one of claims 53 to 56, characterised in that the thread cross-section on the side remote from the open end face (19) of the housing container (5) is bounded by a straight transition surface (69) extending at an angle in the direction towards the open end face (19).

58. Housing container (5) as claimed in claim 57, characterised in that the thread cross-section is bounded between the apex surface (72) oriented parallel with the longitudinal axis (14) and the transition surface (69) with another radius (71).

59. Housing container (5) as claimed in one of claims 56 to 58, characterised in that the first radius (67) is bigger than the other radius (71).

60. Housing container (5) as claimed in one of claims 40 to 59, characterised in that the thread beginnings (54 to 56) extend into the region of the external surface (18) close to its open end face (19).

61. Housing container (5) as claimed in one of claims 40 to 60, characterised in that its external surface (18) is provided with a coating at least in the region of the thread (42).

62. Housing container (5) as claimed in one of claims 40 to 61, characterised in that at least certain regions of the thread arrangement (40), in particular the thread or threads (42), are provided with the coating.

63. Housing container (5) as claimed in one of claims 40 to 62, characterised in that it is provided with the coating at least in the region of an internal surface (18) which can be directed towards a sealing surface 33 of a sealing device 21.

64. Housing container (5) as claimed in one of claims 61 to 63, characterised in that the coating is formulated to reduce friction and contains at least one lubricant or a lubricant

additive.

65. Housing container (5) as claimed in one of claims 40 to 64, characterised in that the at least one thread (42) has a surface roughness of between 0.0125 μm and 0.05 μm at least on the portion co-operating with the other thread (43) of the cap (20).

66. Housing container (5) as claimed in one of claims 40 to 65, characterised in that a retaining mechanism (79) is disposed in the region of a separating device (77) which can be inserted in the interior (10) with a view to establishing its initial position.

67. Housing container (5) as claimed in claim 66, characterised in that the retaining mechanism (79) is provided in the form of at least one shoulder (81) projecting out from the circumference of the internal surface (80) in the direction towards the longitudinal axis (14).

68. Housing container (5) as claimed in claim 66 or 67, characterised in that the retaining mechanism (79) is provided in the form of at web (82) projecting out from at least certain regions of the circumference of the internal surface (80) in the direction towards the longitudinal axis (14).

69. Housing container (5) as claimed in claim 68, characterised in that the web (82) is disposed continuously around the circumference of the internal surface (80).

70. Housing container (5) as claimed in one of claims 66 to 69, characterised in that the retaining mechanism (79) is provided in the form of a reduction in an internal dimension (13) of the interior (10).

71. Housing container (5) as claimed in one of claims 66 to 70, characterised in that the retaining mechanism (79) is provided in the form of a groove-shaped recess extending round the circumference of the internal surface (80).

72. Housing container (5) as claimed in one of claims 66 to 71, characterised in that a positioning mechanism (83) is disposed in the region of a working position for the separating device (77) to be inserted in the interior (10).

73. Housing container (5) as claimed in claim 72, characterised in that the positioning mechanism (83) is provided in the form of a reduction in an internal dimension (84) of the interior (10).

74. Housing container (5) as claimed in claim 72 or 73, characterised in that the positioning mechanism (83) is provided in the form of an abutment surface (85) oriented more or less perpendicular to the longitudinal axis (14).

75. Housing container (5) as claimed in one of claims 40 to 74, characterised in that a tapered region of the housing container (5) in its interior (10) or its housing compartment (117) between the two planes (15, 16) is between 0.1° and 3.0° , preferably between 0.6° and 1.0° .

76. Housing container (5) for forming a container system (10 for body fluids, tissue parts or tissue cultures which can be closed by means of a closure device (9), which housing container (5) has two ends (6, 7) spaced apart from one another in the direction of a longitudinal axis (14) and bounding an interior (10), and at least one of the two ends (6, 7) has an open end face (19) which can be closed by the closure device (9) and re-opened again, and a separating device (77) can be inserted in the interior (10) into its initial position through the open end face (19), characterised in that at least one flow passage (87) is formed between a container wall (11) of the housing container (5) and the insertable separating device (77) in the region of the initial position of the insertable separating device (77).

77. Housing container (5) as claimed in claim 76, characterised in that the at least one flow passage (87) has a minimum flow cross-section (98) of at least 0.4 mm^2 in the plane (49) oriented perpendicular to the longitudinal axis (14).

78. Housing container (5) as claimed in claim 76 or 77, characterised in that the at least one flow passage (87) is provided in the form of a cut-out (88) recessed into an internal surface (80) of the housing container wall (11).

79. Housing container (5) as claimed in claim 78, characterised in that a longitudinal extension (95) of the cut-out (88) in the direction of the longitudinal axis (14) terminates in

front of a sealing surface (34) which can be directed towards a sealing surface (33) of a seal stopper (22).

80. Housing container (5) as claimed in claim 78 or 79, characterised in that the longitudinal extension (95) of the cut-out (88) in the direction of the longitudinal axis (14) terminates in front of the operating or separating position of the separating device (77) in the direction remote from the open end face (19).

81. Housing container (5) as claimed in one of claims 78 to 80, characterised in that the cut-out (88) extends from the internal surface (80) in the radial direction towards the external surface (18) across a depth (89) of between 0.1 mm and 1.0 mm, preferably between 0.2 mm and 0.5 mm.

82. Housing container (5) as claimed in one of claims 78 to 81, characterised in that several cut-outs (88) are distributed around the internal circumference.

83. Housing container (5) as claimed in claim 82, characterised in that the cut-outs (88) are distributed symmetrically around the internal circumference.

84. Housing container (5) as claimed in one of claims 78 to 81, characterised in that the cut-out (88) is disposed continuously around the internal circumference.

85. Housing container (5) as claimed in one of claims 78 to 84, characterised in that a first transition surface (93) is disposed between a base surface (90) of the cut-out (88) and at least one of the boundary surfaces (91, 92) of the cut-out (88) spaced apart from one another in the direction of the longitudinal axis (14).

86. Housing container (5) as claimed in one of claims 78 to 85, characterised in that another transition surface (94) is disposed between one of the boundary surfaces (91, 92) of the cut-out (88) spaced apart from one another in the direction of the longitudinal axis (14) and the internal surface (80).

87. Housing container (5) as claimed in claim 85 or 86, characterised in that at least one

of the transition surfaces (93, 94) or boundary surfaces (91, 92, 96, 97) has a concave curvature.

88. Housing container (5) as claimed in one of claims 85 to 87, characterised in that at least one of the transition surfaces (93, 94) or boundary surfaces (91, 92, 96, 97) is flat.

89. Housing container (5) as claimed in one of claims 85 to 88, characterised in that at least one of the transition surfaces (93, 94) or boundary surfaces (91, 92, 96, 97) is convexly curved.

90. Housing container (5) as claimed in claim 76 or 77, characterised in that the at least one flow passage (87) is provided in the form of a rib (106) projecting out from an internal surface (80) of the container wall (11) in the direction towards the longitudinal axis (14).

91. Housing container (5) as claimed in claim 90, characterised in that the at least one rib (106) is oriented parallel with the longitudinal axis (14).

92. Housing container (5) as claimed in one of claims 40 to 91, characterised in that it has a surface structure, in particular with a lotus blossom effect, at least in the region of the flow passage (87).

93. Housing container (5) as claimed in one of claims 76 to 92, characterised in that a second part of a thread arrangement (40) is disposed on the external surface (18) thereof, and a pitch angle (60) of at least one thread (42) of the thread arrangement (40) is between 2° and 25° by reference to the plane (49) oriented perpendicular to the longitudinal axis (14).

94. Housing container (5) as claimed in one of claims 76 to 93, characterised in that it is as claimed in one of more of claims 19 to 39.

95. Container system (1), comprising at least a cap (20), a sealing device (21) retained in it and a housing container (5), characterised in that the cap (20) is as claimed in one of claims 19 to 39 and the housing container (5) is as claimed in one of claims 40 to 94.

96. Container system (1) as claimed in claim 95, characterised in that a sealing device (21) inserted in the cap (20) is provided with a coating prior to being inserted, at least in the region of a sealing surface (33) which can be directed towards the internal surface (18) of the housing container (5).

97. Container system (1) as claimed in claim 95 or 96, characterised in that an interior (10) sealed off from the external atmosphere is reduced to a pressure lower than the external ambient pressure, in particular is evacuated.

98. Container system (1) as claimed in one of claims 95 to 97, characterised in that a retaining ring (31) is disposed between a shoulder (31) projecting radially around a stopper (48) of the sealing device (21) and a projection (29) of the cap (20) spaced at a farther distance from the housing container (5).

99. Container system (1) as claimed in one of claims 95 to 98, characterised in that an internal clearance width (118) of the projection (30) of the cap (20) which can be directed towards an open end (6) of a housing container (5) more or less corresponds to an external dimension (119) of the housing container (5) in the region of its open end (6).

100. Container system (1) as claimed in one of claims 95 to 99, characterised in that at least one passage (117) is formed between the sealing device (21) and an open end (6) of the housing container (5) when the threads (42, 43) of a thread arrangement (40) on the housing container (5) and on the cap (20) are still engaged.

101. Container system (1) as claimed in claim 100, characterised in that the passage (117) is formed between a stopper (48) of the sealing device (21) to be inserted in the interior (10) and the open end (6) of the housing container (5).

102. Container system (1) as claimed in claim 100 or 101, characterised in that an oblique surface (120) tapering in the direction towards the longitudinal axis (14) is provided on the stopper (48) of the sealing device (21) between a sealing surface (33) facing the housing container (5) and another sealing surfaces oriented perpendicular to a longitudinal axis (14) and directed towards the interior (10).

103. Container system (1) as claimed in one of claims 95 to 102, characterised in that the sealing surface (33) on the stopper (48) has a dimension (121) of between 1.0 mm and 2.5 mm, preferably 1.5 mm, in the direction of the longitudinal axis (14).

104. Container system (1) as claimed in claim 100, characterised in that the passage (117) is provided in the form of at least one groove-shaped recess (122) disposed in the region of a sealing surface (33) of the stopper (48).

105. Container system (1) as claimed in claim 104, characterised in that the recess (122) extends from a peripheral region (123) directed towards an interior (10) of the housing container (5) in the direction toward the shoulder (32) and terminates before it at a distance (124) of between 1.0 mm and 2.5 mm, preferably 1.5 mm.

106. Container system (1) as claimed in one of claims 95 to 105, characterised in that at least one passage (102) is disposed in the portion of a groove-shaped accommodating region in the cap casing (23), in which at least certain regions of the inserted sealing device (21), in particular its shoulder (32), are engaged.

107. Container system (1) as claimed in one of claims 95 to 106, characterised in that additional catch means are provided between the shoulder (32) of the sealing device (21) and the cap (20), in particular its cap casing (23).